NEW GROWTHS AND CANCER

WOLBACH

'ARD HEALTH TALKS

HARVARD HEALTH TALKS

THE CARE OF CHILDREN
BY JOHN LOVETT MORSE

PRESERVATIVES AND OTHER CHEMICALS IN FOODS: THEIR USE AND ABUSE
BY OTTO FOLIN

THE CARE OF THE SKIN
BY CHARLES JAMES WHITE

THE CARE OF THE SICK ROOM
BY HERBERT CERRY CUTLER

THE CARE OF THE TEETH
BY CHARLES ALBERT BRACKETT

ADENOIDS AND TONSILS
BY ALGERNON COOLIDGE

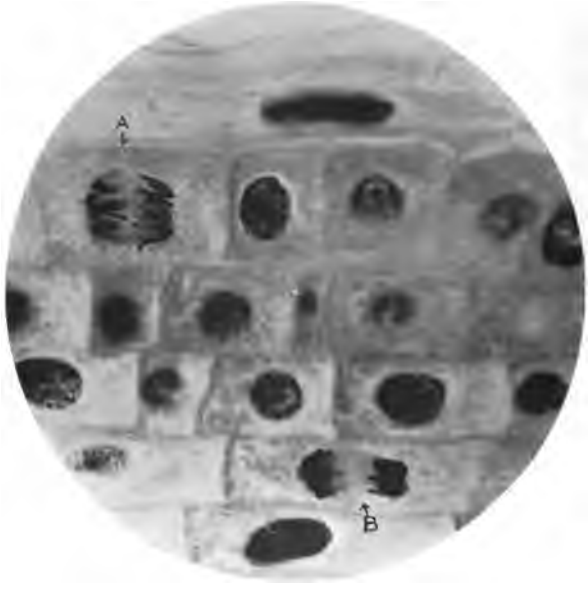
AN ADEQUATE DIET
BY PERCY GOLDTHWAIT STILES

HOW TO AVOID INFECTION
BY CHARLES VALOR CHAPIN

PNEUMONIA
BY FREDERICK TAYLOR LORD

NEW GROWTHS AND CANCER
BY SIDNEY BURT WOLBACH

HARVARD HEALTH TALKS



I. Photomicrograph of a section of the tip of a rapidly growing onion root, showing the cellular structure. The rectangular outlines represent individual cells, the dark bodies enclosed are the nuclei. At (A) and (B) are two different stages in the division of nuclei preparatory to cell division. At (A) individual chromosomes are well shown.

HARVARD HEALTH TALKS

NEW GROWTHS AND CANCER

BY

SIMEON BURT WOLBACH
SHATTUCK PROFESSOR OF PATHOLOGICAL ANATOMY
IN HARVARD UNIVERSITY

CAMBRIDGE
HARVARD UNIVERSITY PRESS
LONDON: HUMPHREY MILFORD
OXFORD UNIVERSITY PRESS
1922

HARVARD HEALTH TALKS

PRESENTING the substance of some of the public lectures delivered at the Medical School of Harvard University, this series aims to provide in easily accessible form modern and authoritative information on medical subjects of general importance. The following committee, composed of members of the Faculty of Medicine, has editorial supervision of the volumes published:

EDWARD HICKLING BRADFORD, A.M., M.D., Dean of the Faculty of Medicine, and Professor of Orthopedic Surgery, Emeritus.

HAROLD CLARENCE ERNST, A.M., M.D., Professor of Bacteriology.

WALTER BRADFORD CANNON, A.M., M.D., George Higginson Professor of Physiology.

NEW GROWTHS AND CANCER

ndividual
re bridged
en named

NEW GROWTHS AND CANCER

I. Cells and Tissues

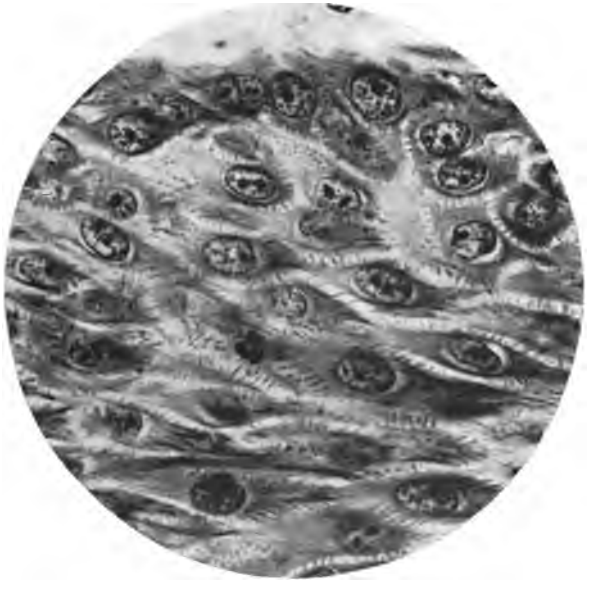
THE unit of structure of living matter is the cell. Under the microscope these units or cells are as fully evident as are the stones or bricks of a building to the naked eye, but in the human body there are many more kinds of cells than there are materials usually employed in building.

All these different cells which compose the complex structures of the body arise from a single cell, the fertilized ovum, by continuous growth and division and differentiation. In the development of the individual, growth and division of cells must precede differentiation. Differentiation results finally in the diverse types of cells of the body, each type dedicated to the performance of some duty (func-

tion) in the body. In general the more highly specialized the function the more feeble is the power of growth and division that remains with the cell. Some ability to grow and divide must remain with those cells of the body that are concerned with the repair of injuries. Thus there are cells with two kinds of function, one of which is that of growth and division for the purpose of repair, and another the performance of a highly specialized duty such as secretion or excretion.

Groups of cells with similar functions are known as tissues.

In a rough way we may divide the cells or tissues of the body into two groups, the connective tissues whose functions are chiefly mechanical, as fibrous tissue, bone, and muscle, and the epithelia whose functions are chiefly chemical in nature and concerned with secretion and excretion, or the production of protective surface material.



II. Section through human epidermis showing individual cells separated by dropsical fluid. The spaces are bridged by fibrils because of which the cells have been named "prickle" cells.

The connective tissues do not come into direct contact with the outer world because all surfaces of the body, such as the skin, the cavities of glands, and the inside of the intestinal and genital tracts are covered with epithelia. With but few exceptions, the epithelia have one surface in contact or communication with the outer world, although the route is in many instances circuitous. One surface of epithelium must be in contact with connective tissue for the purposes of support and nourishment.

The epithelia are always required to do at least two things, preserve their continuity of surface and perform some chemical function.

The connective tissues are characterized chiefly by the peculiarities of the substances lying between the cells — intercellular substance or matrices elaborated by the cells. Intercellular substances differ widely according to the function of the tissue, rigid and calcified

as in bone, pliable and resilient as in cartilage, and tough and elastic as in the connective tissue of the skin.

Biologists are beginning to understand a few of the processes that take place within the cell and at the junction of the cell surfaces and surrounding media, but the physiology of the intercellular substance is still an wholly unexplored field, probably of great importance in tumor research.

II. General Statements about New Growths

New growths or tumors of all sorts, including cancer, are composed of cells which are derived from the cells of the body of the individual in whom the tumor occurs.

There are as many different kinds of tumors as there are tissues in the body. In most other diseases the changes visible to the eye are the result of the disease, i. e., the reactions of the body to

the cause of the disease. These reactions are the evidences of injury and efforts on the part of the normal tissues towards repair. In cancer (and all tumors) that which we see is the disease. Many diseases, including all infectious diseases, run courses dependent upon the presence of a definite cause, but the course of tumors is dependent upon factors inseparable from the tumor cells and therefore tumors can be cured only by procedures which result in the destruction or removal of all of the tumor cells.

An exact or wholly satisfactory definition of tumors or new growths cannot be given, but we may summarize the more important properties of tumors in the following statements:

A tumor is a new formation or mass of cells which arise from preëxisting cells in the body. While the individual cells of a tumor may be exact replicas of normal cells, their arrangement is unlike that in normal structures, also the cells usually

have embryonic characteristics, that is, are not fully differentiated.

Tumors serve no useful purpose and grow at the expense of the body as a whole.

The growth of tumors is independent of the factors governing the growth of normal tissues and is typically without limit.

The independence of growth of tumors is well illustrated by the fact that they often grow with rapidity in individuals who are losing weight. Huge benign tumors of fat cells may occur in persons who are otherwise almost without fat tissue.

Of the properties of tumor cells enumerated, the two most important are the ungoverned growth rate and the lack of differentiation. We say lack of differentiation because the cells resemble embryonic cells of the same origin, but if tumors arise from preëxisting adult cells, as we believe they do, this change may

be better expressed as a re-differentiation or a dedifferentiation.

There is strong evidence that redifferentiation of epithelial cells does take place in consequence of long continued demands upon one of their functions, that of repair, involving proliferation, and that processes creating this demand may be directly responsible for the origin of malignant new growths.

New growths occur as benign formations of cells, not intrinsically inimical to life, and as malignant formations of cells, those with properties inimical to life. Benign tumors remain local and are usually sharply demarcated from the normal tissues in which they arise. Their cells, and often their structure, resemble those of normal tissues and their chief effect is mechanical, in producing deformity or pressure effects. Pressure effects from a benign tumor may, of course, prove fatal if not relieved when the tumor is situated so as to press upon

vital structures, as those within the chest and skull.

Examples of benign tumors are adenomas (gland-like tumors) which arise from epithelial tissues, as breast glands; and fibromas, chondromas and osteomas, arising from fibrous tissue, cartilage and bone respectively. A very common benign tumor, frequently the cause of great distress, is the so-called fibroid of the uterus, actually a tumor of smooth muscle cells identical in type with those forming the wall of the uterus.

Malignant tumors do not remain local. Their cells have the power to invade or infiltrate adjacent normal tissues, and by their superior power of growth, to bring about the destruction of normal tissues. Most malignant tumors have the property of invading lymphatics and blood vessels, so that cells which become detached are transported to distant regions, and there give rise to new masses of tumor. This process of exten-

sion is called metastasis. The extensive dissections made by surgeons when removing a relatively small cancer are done in anticipation of metastases and in these dissections the endeavor is made to remove all of the lymphatics and lymph nodes directly connected with (draining) the locality of the tumor.

We need not concern ourselves with the elaborate nomenclature of tumors. Popularly, all malignant tumors are cancers. To the physician malignant tumors arising from epithelial tissues are carcinomas or cancers, while those arising from connective tissues are sarcomas.

Tumors, benign and malignant, are supplied by blood vessels, though not with nerves. The growth of blood vessels which accompanies the growth of tumors is purely a secondary response in obedience to laws governing growth of tissue in general. In tumors of epithelial origin we have always an accompanying growth of connective tissue carrying blood ves-

sels, essential for the support and nutrition of the tumor cells. In malignant tumors the cells often grow at a rate which is relatively much faster than that of the accompanying blood vessels, so that the volume of tumor tissue becomes too great to be adequately nourished by the blood supply. The tumor cells also often compress, invade and occlude their own blood vessels. These behaviors cause the death (necrosis) of portions of the tumor, and when the tumor is upon the surface of the body the necrotic portions soften and separate from the main mass (slough off). The striking destructive action of some tumors (the "eating away") is thus accounted for. Foul odors associated with tumors are solely due to the presence of putrefactive (harmless) bacteria which find conditions favorable for growth in exposed necrotic tissues.

The so-called roots of a cancer are simply the irregular extensions of the

growth into normal tissues, they are more like branches than roots, should we feel obliged to obtain a descriptive term from botanical sources.

III. On the Causes of Cancer

Cancer is by far the most important malignant new growth, and accordingly has had the most thought and research devoted to its problems.

I say causes rather than cause of cancer, for the reason that the evidence points to more than one initiating cause. It is not unreasonable to believe that eventually we shall arrive at an understanding of the factor or factors possessed in common by the cells of all malignant growths, that is the immediate cause of unlimited ungoverned multiplication of cells.

A consideration of the immediate "causes" of tumors would lead us into highly technical fields of general biology, biological chemistry and biological

physics, all involved in the problems of balanced (normal) cell growth in the body. Unbalanced, or ungoverned growth even to the extreme of unlimited growth would seem to be a potentiality of many types of cells in the body throughout life. In normal cells there are factors which control the rate of growth and these factors seem to be operative chiefly in the cell "membrane" and are more or less subject to study. I shall give some examples of the way cells are stimulated to multiplication. Ova of lower animals (the frog for instance) which ordinarily require the penetration of a spermatozoon to induce multiplication, may be stimulated to growth resulting in the formation of embryos by the addition of chemicals to the water in which they are kept. Such chemicals are weak acids and alkaline salts, which apparently act by affecting the character of the cell membrane (Jacques Loeb) thereby increasing its permeability. An

increased permeability means breaking down barriers between the cell and its environment so that potential sources of energy within the cell become dynamic. Multiplication of cells remotely simulating tumor growth in man may be induced in plants by the injection of acid and alkaline substances into plant tissues, and where such substances can be constantly supplied to the cells the growth becomes continuous and unlimited, as in the case of plant infections with a bacterium, *Bacterium tumefaciens*. This bacterium grows within the plant cells and as shown by Irwin Smith causes continuous proliferation, not by any mechanical stimulation, for many other bacteria invade plant cells without producing a similar result, but by the chemical substances elaborated by the bacterium.

A less striking example, but more familiar, of plant cell proliferation in direct response to chemical stimulus is

seen in the production of plant galls by the larvae of insects. There are thousands of species of gall-producing insects, representing six orders, distributed throughout the world.

In man we have learned that some of the conditions governing growth are influenced or regulated by the output of certain ductless glands. The changes in the breasts during pregnancy, in preparation for lactation, include extensive multiplication of the glandular epithelium and we know that these changes are dependent upon a secretion from the ovaries. Disorders of the pituitary gland — a ductless gland — influence to a remarkable degree the growth of the body, and here again we get striking examples of over-production of tissues due to the presence of, as yet, unidentified chemical substances in the blood. Giant growth in rats has been experimentally produced by repeated injections of pituitary gland substance into young individuals. Con-

ditions resulting in under-production on the part of the same gland in early life retard growth and development to sexual maturity.

Experimentally in animals local growths of epithelium can be produced as a direct response to the presence of injected substances (a dye-stuff dissolved in oil).

Local over-production of tissues often occurs in the repair of injuries on the part of such tissues as bone and epithelium, but after complete healing has taken place the excess tissue disappears. What happens with repeated injuries and in conditions where complete repair is not possible is another story, to which I shall return.

I give these cursory illustrations in order to show that the problems connected with the normal and abnormal growths of cells are not beyond the scope of investigation and to enable me to venture the prediction that eventually we

shall have in our possession knowledge of the fundamental laws relating to cell growth and multiplication. Modern physical chemistry as applied to biological chemistry is rapidly breaking ground.

IV. Tumor Research

Tumor research is being carried on by individuals in all great medical centers, and in some universities under special endowments, as that of the Crocker Fund at Columbia University and the Cancer Commission of Harvard. Considering the importance of the subject far too few workers are engaged, and the capital set aside for financing such research is absurdly small, in view of the magnitude of the problems. If all the cancer research institutions of the world were fused into one, it is questionable if they would yield means and men sufficient for an adequate organization to attack the problems of cancer causation

and therapy along the clearly indicated lines of investigation now mapped out.

I have already indicated the ways in which cell growth is being studied. The behavior of tumors as a whole in the last twenty years has been much studied in animals, for it is frequently possible to maintain tumors of mice, rats, and fowls indefinitely by grafting portions of the tumor from individual to individual. Such "strains" of tumor exist in many laboratories and furnish the means of testing out many hypotheses in regard to growth, and particularly treatment.

Growth of cells outside the body has become possible in recent years. Normal cells as well as tumor cells can be maintained continuously growing in glass containers if transferred at intervals to new supplies of the proper medium. In the case of such "cultures" from normal cells we have apparent proof of the unlimited growth capacity of cells of simple tissues. Obviously such cultures afford

opportunities for the investigation of factors affecting the growth of mammalian cells not possible in the animal body.

V. Accepted Theories of the Origin of Tumors in Man

A consideration of observed facts in man leads us to the conclusion that tumors of early life are quite distinct in origin from those of late life. In infancy and early childhood practically all solid tumors are malignant, and mixed tumors, that is tumors with two types of cells, are common. The tumors appearing in early life usually arise in organs which have a complicated development and in these organs we frequently find, even in adults, isolated groups of cells which must have remained there from the embryonic stage. There is all in all much evidence supporting the theory that tumors of early life arise from so-called "misplaced" cells or "embryonic rests," cells

which fail to take part in the development of an organ but which remain included in the organ. An excellent example of an "embryonic rest" is furnished by the pigmented moles generally known to be present from birth. These moles consist of groups of pigment-forming cells identical with those occurring normally in some stages of the development of the skin. They lie just below the epithelial layer of the skin (epidermis) and occasionally are the seats of origin of a very fatal type of tumor.

Tumors of early life are often associated with gross congenital defects which is additional evidence of their origin in developmental defects.

There are tumors of congenital origin, seen fairly frequently, which have an exceedingly complex structure, containing many kinds of tissues, and even abortive attempts at organ production, so that we often find in them bone, car-

tilage, teeth, glands and skin with hair. These tumors are called teratomas, they are usually benign, and I speak of them to bring further evidence of the congenital origin of certain tumors, for it is evident that they have origin in cells set aside very early in the development of the fetus.

On the whole the tumors of early life — those of congenital origin — are of minor importance compared with those of later life. We feel certain of their origin in cell rests but have no clue as to why some cell rests become tumors and others do not. The fact that the study of tumors of late life promises more of practical value probably accounts for the small amount of research given to the tumors of early life.

Of the malignant tumors of late life, that is, after forty years, the bulk are epithelial. Malignant connective tissue tumors (sarcomas) occur, but I can give you so little in the way of fact or theory

to account for any of the several types that I must dismiss the subject with the statement that they are less frequent and therefore of lesser moment as compared with the cancers.

With benign tumors we are also less concerned. They occur frequently and may cause great discomfort; for instance the fibroid of the uterus (a connective tissue type) in women and the adenoma of the prostate (epithelial) in men, but they are fortunately both amenable to treatment by surgery.

The malignant epithelial tumors (cancers) are by far of greatest importance. Twenty-five years ago the idea of cancer being associated with or due to other pathological processes was scouted. The possibility of its being caused by a parasite was eagerly entertained, and heredity was given a prominent place in all discussions.

Today even the most conservative pathologist admits the importance of the

effects of long continued injurious or inflammatory processes upon epithelium in cancer production. The parasitic theory of cancer causation is almost wholly abandoned, though the indirect effect of certain parasites is held in the same regard as that of long continued or often repeated injuries. The statistician has disproved heredity as an important factor, and insurance companies attach no importance or penalty to a history of cancer in the family of an applicant for insurance.

These statements, which meet with general scientific approval, may be made in regard to cancer in man: —

Cancer is not infectious, i. e., "not catching."

Cancer is not hereditary.

Cancer is definitely associated with the long persistence of processes, loosely called chronic inflammation, in the location in which they arise. Upon the acceptance of this last statement rest the

activities of those concerned in cancer prophylaxis.

What is the nature of our evidence that cancer may be identified by preceding conditions? This evidence may be grouped under the following headings: —

Cancer characteristic of certain occupations.

Cancer characteristic of peculiar practices of peoples.

Cancer and its association with chronic infectious processes of skin and mucous membranes.

The experimental production of cancer by the duplication of the conditions of some of the above in animals.

VI. Cancer and Recognizable Predisposing Pathological Conditions

A. *Cancer and Occupation.* The classic example is that of chimney-sweep's cancer, cancer of the scrotum due to the mechanical and chemical action of soot

over long periods of time. Gardeners who use soot as a fertilizer or fungicide, workers in carbon factories, and those who handle tar, paraffin, aniline oil and other products of the distillation of coal, are subject to cancers of the hands and face. In all the evolution of the cancer is the same, a chronic thickening of the skin, i. e., dermatitis, warty growths, then ulceration and cancer.

The last twenty years have furnished us with an even more striking example of occupational cancer, the cancers of X-ray workers. In 1909 Dr. C. A. Porter collected thirty-six cases, living and dead, and I venture to assert that nearly all of the thirty-six are now dead. Most of them were in young men, doctors, who, as a result of repeated exposure to the X-rays incurred in their daily work of diagnosis and treatment, developed thickening of the skin, warty growths, ulcerations and cancer. Heroic fortitude and devotion to duty by medical men

have never been better illustrated than by the last years of some of these victims, for instance, the much honored and lamented Walter Dodd of the Massachusetts General Hospital.

Wholly analogous to X-ray cancer are those arising upon the face and hands of persons much exposed to sun and wind, farmers and sailors.

Cancer as an occupational disease is an established fact, and as has already been demonstrated in practice, easily preventable.

B. *Cancers Associated with Peculiar Practices.* I shall give but three. In Kashmir it is the custom for members of a certain tribe to wear, for the purpose of warmth, a small earthenware stove, enclosed in wicker-work, beneath their robes. This stove is attached to a belt and rests in contact with the skin. As a result a chronic inflammation is set up and relatively many individuals develop cancer of the skin upon this area. Closely

related tribes, living at lower altitudes, who do not employ this portable stove, do not have this disease. Now cancer of the skin of the abdomen is extremely rare anywhere else in the world, so that the evidence of a causal relationship of the practice and the disease is very strong.

Another example is that of cancer of the cheek in India in women who are addicted to chewing betel leaves. The preparation of betel leaves, lime and other ingredients employed is kept quite constantly in one position, between the cheek and the teeth, even during sleep. The occurrence of cancer on the side kept in contact with the betel leaves and lime is good evidence of causal relationship, for cancer of the cheek in women in general is very rare.

I do not know whether to class the third example as a peculiar practice or not. It was so regarded for a time in all

civilized countries, and when indulged in by women is still so regarded in a few localities. I refer to smoking! Cancer of the mouth parts and pharynx is incontestably proved to be more common in smokers than in non-smokers. Our statistics so far apply to men, but emancipated women will in this respect also soon contribute to the world's information.

C. *Cancer and Chronic Infectious Processes.* In man we have as examples syphilis of the mucous membranes, particularly of the mouth, and an associated relatively high cancer incidence; the frequent occurrence of cancer upon a form of skin tuberculosis known as lupus; and cancer of the bladder following chronic ulcerations due to the embryos of a small worm. The last is a disease very common in all parts of Africa. The adult worm, a filaria (*Bilharzia hematobia*), localizes in veins in the bladder

region, and the only route of exit for the embryos is through the bladder.

In rats cancer of the stomach is likewise the indirect result of infection with another small worm (*Spiroptera neoplastica*) which the rat gets from eating cockroaches. The embryos of this worm are found in the muscles of the cockroach. This cancer of rats has been reproduced experimentally by introducing the *Spiroptera* embryos into the rat's food.

D. *Experimental Production of Cancer in Animals.* Experimentally cancer has been reproduced in animals by X-ray exposures (the cases in man may be regarded as unintentional and unconditioned experiments), by inoculation with the cockroach rat worm, and by long continued applications to the skin of substances obtained from coal tar.

VII. Analysis of the Conditions Antecedent to Cancer in its Relation to Chronic Pathological Processes of Diverse Types

Is there a plausible explanation to account for cancer formation following long continued inflammatory processes?

In analyzing the conditions we must consider several facts: (1) that the new growths are always of epithelial origin, i. e., cancer; (2) that epithelium is dependent upon the supporting connective tissue with its blood and lymphatic supply for nourishment; (3) that one of the functions of epithelium is to cover surfaces, and that, therefore, it has great proliferative powers; and, finally (4) that all the known chronic processes leading to cancer formation are attended by repeated destructive changes in the connective tissue supporting the epithelium, thereby leading to recurring breaks in continuity of the epithelium neces-

sitating repair by proliferation. Furthermore, as a result of the persisting inflammatory processes, the supporting connective tissue remains subject to constant or recurring changes resulting in conditions presumably less adequate than the normal for the nutrition of the epithelium. There is much evidence, but of too technical a nature to be discussed here, which indicates that the origin of some internal cancers takes place upon seats of long continued inflammatory processes.

Now the time element is important in cancer production. In man, years, in X-ray cancer a minimum of six years, are required. In animals it requires the repeated application of coal tar products for a year or more in order to produce new growths.

These observations lead to the conclusions that the acquisition of the power of unrestrained growth is a slow process, that it is one restricted to the locality

subjected to the injuries, that it is a property of individual cells and not dependent on factors affecting the body as a whole, and that it is a result of the repeated calls for the performance of the function of multiplication at the expense of more highly specialized functions.

The acceptance by the medical world that long continued inflammatory processes of various and diverse causation may result in cancer production is a fact of greatest importance, as it points to certain rational measures of prevention, and justifies surgical procedures now employed. If the reasoning I have just presented is a true interpretation of what occurs, it accounts for the beliefs firmly held by most of us that cancer is in its beginning a local disease, and not transmissible by heredity.

VIII. The Treatment of Cancer

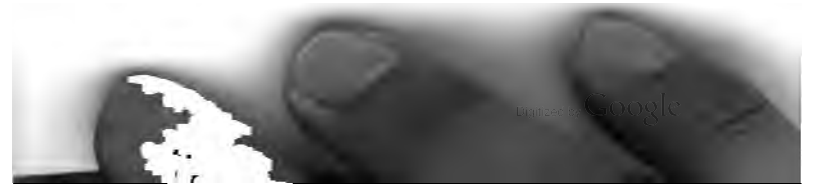
To find a means of preventing the growth of tumor cells or of destroying

them completely without inflicting important damage to the body as a whole is the goal of all cancer research. All biological research directed towards the understanding of the behavior of living matter is cancer research, and I am inclined to believe that the researches of persons who know little or nothing about cancer are contributing the most fundamental information, as they have done in the past. The known agents which can be employed are radiant energy, from radium and the X-rays, and possibly chemical compounds.

Theoretically success is dependent upon the possible existence of differences in manner of living (metabolism) between normal cells and cancer cells, and the further possibility that such differences may enhance the susceptibility of cancer cells to the agents at our command. Have we evidence that such differences exist? I have already mentioned that the cells of tumors are less

differentiated than the normal type, that tumors have no nerve supply, and that they have an atypical blood supply and arrangement of cells.

Experiments upon animals and practice upon cancer cases in man have shown a decidedly greater susceptibility of tumor cells to X-rays and radium as compared with most normal tissues. Superficial tumors have been completely destroyed by both agents. Deep seated tumors present difficulties because the radiant energy of the X-ray tube and radium is deleterious to all tissues and the estimated required dosage cannot always be applied with safety and perhaps not achieved with the present X-ray apparatus or supply of radium. Each year sees some advance in the progress made with these physical agents and the possibilities are by no means exhausted in regard to volume of rays and kind of rays, for the rays from X-ray tubes and radium vary in wave length just as do



the longer rays we call light. We may look with interest to the future achievements from the new laboratory of the Harvard Cancer Commission, with its new and powerful apparatus yet to be tried upon patients.

The investigation of chemical agents is necessarily still restricted to animals. Faint clues seem to be at hand as there is evidence that in the transplantable tumors of mice the tumor cells have a greater affinity for certain organic salts of the heavy metals than have normal cells, the most striking effect obtained thus far being that with a compound of the metal tellurium and the dye-stuff eosine. The growth of sarcomas in rats has been remarkably retarded by the use of a chemical (phloridzin), the administration of which causes a great loss of carbohydrates from the body by way of the urine. Lime in excess in the food of rats also is reported to retard the rate of growth of sarcomas. These observations

as yet are of no practical importance whatever, but they apparently demonstrate that there are accessible differences between tumor cells and normal cells and that the subject is one open to experimentation.

The practical procedures in tumor treatment are two: surgery and X-rays or radium. Surgery aims at complete removal of the new growth. Therefore success with surgery is dependent upon whether or not complete removal is physically possible or compatible with life of the individual. As cancer is a local disease, there is always a stage when complete removal and cure is possible. Successful surgical treatment then is a matter of early removal.

X-rays and radium require very special knowledge for their application, and are positively dangerous in the hands of the inexperienced. Like many deleterious agents, a weak dosage may stimulate where a strong dosage destroys.

The medical profession as a whole advocates surgery in all cases where a complete removal of a tumor is possible, except in cases of benign tumors and the less dangerous cancers of the surfaces of the body. But these agents have other very important uses in cancer therapy, first as adjuncts to surgical treatment, and second as palliative measures, and it is often possible by their means to cause superficial healing of exposed tumors, thereby removing the source of foul odors and irritating discharges, thus adding greatly to the comfort of the patient.

IX. Prophylaxis

Last year (1921) the American Society for the Control of Cancer inaugurated a Cancer Week which was held a few months ago in every city of size throughout the country. Doctors and Public Health officials were called upon to give lectures and demonstrations for the purpose of informing the public (medical as

well as lay) about cancer, in an effort to reduce the death rate. As cancer cannot be transmitted from person to person (not "catching") the whole purpose of the campaign was to educate individuals and, sad to say, doctors as well. The campaign was justified by two public conditions, the ignorance and indifference of individuals in regard to the early evidence of cancer, and the too frequent lack of discrimination shown by persons in selecting the kind or cult of medicine for their treatment.

Cancer prevention is wholly a matter pertaining to the individual.

The avoidance of exposure to the known initiating causes, the paying of attention to signs possibly indicative of early cancer, and the consultation of a reputable physician with the purpose of following his advice, sum up what is practical in the prophylaxis of cancer.

What signs should lead us to suspect the presence of a cancer or conditions

liable to be followed by one? The signs of cancer in places that we can ourselves inspect are usually very evident. An increase in size of a mole, a lump appearing in the breast, warty growths of the skin followed by shallow scabbed ulceration, fissures or tiny ulcers of the lips, cheeks or tongue, that do not heal, are all examples of possible early cancer that are commonly neglected. It is estimated that there are over eight thousand deaths from cancer of the breast yearly in the United States, most of which could have been cured if taken in hand early enough.

In regard to the internal organs, any new and persistent symptoms in a person past forty years of age should be looked into. Sudden constipation in a previously regular person, or the onset of a dysentery which remains persistent, or bleeding from the rectum, may be the first indication of a cancer of the lower bowel. In women persistent flowing

between periods and after the menopause are suggestive of early cancer of the uterus.

Pain is a late symptom of cancer, its presence indicates sufficient extension of the new growth to cause pressure upon nerves and hence cancers causing much pain are usually less favorable cases for treatment.

X. On Cancer Statistics

The death rate from cancer for recent years in countries where causes of death are registered varies roughly from 75 to 90 per 100,000 persons. This means that cancer as a cause of death ranks with pneumonia, tuberculosis, and kidney diseases, and that about one death in ten is caused by cancer. In the United States the estimated number of deaths from cancer for the year 1918 was 90,000. The number of *recorded* deaths from cancer throughout the civilized world is increasing each year and the annual in-

crease in the death rate (i. e., number of deaths per 100,000 persons) is estimated at about 2.5 per cent. If the annual increase of the *recorded* death rate from cancer is actually the result of a corresponding increase in the rate of *incidence* of cancer, we may be said to be facing a situation of very grave portent. Some statisticians and apparently the Committee on Publications of the American Society for the Control of Cancer do believe that this situation exists. The determination of the incidence of cancer or of the number of deaths due to cancer each year is a matter attended with many difficulties and plausible explanations have been advanced to account for the apparent rapid increase in the death rate. Cancer statistics is mathematics applied to a biological problem. While we cannot impugn the mathematics, we are in duty bound to question the premises, in this case the death returns in the registration states. Do they tell

the whole story, taking into consideration all the possible causes of error, such as improvements in diagnosis, the increase in number of well trained physicians to make diagnoses, and the lengthening of human life so that now more persons reach the cancer age?

I quote the following concluding paragraph of a paper by Professor Willcox of Princeton: "On the Alleged Increase of Cancer." "The cumulative evidence that improvements in diagnosis and changes in age composition explain away more than half and perhaps all of the apparent increase in cancer mortality rebuts the presumption raised by the figures and makes it probable, although far from certain, that cancer mortality is not increasing." Professor Willcox's analysis of the problem and the data he presents carry conviction to those of us who have held fixed, if hazy ideas, that there was something wrong about the story as told by statistics alone.

I think we may feel fairly secure in continuing our general habits of living and without the fear that we are drifting towards an era of cancer. Cancer prophylaxis remains a problem concerning individuals, and education our sole means of effecting results.

XI. A Final Word

The dread of cancer and the reputed futility of medical treatment have always made it easy for the unscrupulous and ignorant pretender in medicine, whether or not the holder of a medical degree, to appeal successfully to cancer patients. The possessors of secret remedies for cancer, usually a salve or paste which removes the cancer — "roots" and all! — in order to avoid the laws governing the practice of medicine, now-a-days attempt to treat patients under the direction of a registered physician. All such cancer pastes contain caustic substances which kill tissues, normal

as well as cancer, though the claim is usually made that a wonderful herb introduced into the mixture is the active agent. There is proof that cancer pastes were used before the pyramids were built, so we may confidently say that their efficiency has had a fair trial. Remedies for internal administration have disappeared, except under the cover of secrecy. The Propaganda for Reform of the American Medical Association and the Federal Bureau of Chemistry have already eliminated the possibility of advertising anything as flagrantly fraudulent as cancer cures by mouth.

Wonderful contributions to therapeutics have been and still are being made through the observations of laymen, but they represent a minute portion of all that has been offered. Today medicine is resolutely discarding many things once used for treatment of disease, but now shown to be valueless, and the practice of medicine begins to achieve the

status of applied science in biology. In science there are no secrets and no cults. Science is built upon demonstrable facts learned through observation repeated many times, and experimentation rigidly controlled. Facts alone are valid premises for theories and hypotheses, and for the imagination of genius which leads to further progress. The reliable knowledge of the world is common property in that it is freely accessible to everyone. The claims of cults, medical or religious, and of individuals, to exclusive knowledge of disease and its treatment, should be regarded as unscientific, unreliable and possibly fraudulent in its inception if not in intention.

The more rapidly the public learns to be discriminating in its choice of physicians, the more rapidly will the standards in the practice of medicine become elevated. Appreciation on the part of the public of the problems of medicine to the extent that we appreciate me-

chanical problems would accomplish much. The possessor of a fine watch usually makes inquiries before he entrusts it to a person for cleaning or repairs; how many of us do the same in selecting a physician? We must remember that doctors are first of all men, with the moral failings and intellectual deficiencies common to mankind, equipped for the practice of their profession with a technical training and not with a mysterious something. Never select a doctor whom you would not accept as a friend and thus gauge his character, but demand as well a fair degree of professional competence. No one person can be expert in all branches of medicine, but we can rely upon any doctor morally qualified to practise his profession, and of average competence, to bring to the assistance of his patients the available resources of medical science wheresoever and in whomsoever to be found.

PRINTED AT
THE HARVARD UNIVERSITY PRESS
CAMBRIDGE, MASS., U. S. A.